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the anterior angle where its breadth is nothing and widening to the lateral angles where its breadth equals half an inch. The outer line of this margin between the lateral and basal (?) angles is straight, giving its greatest breadth about the middle of these sides where it equals an inch. The margin of the basal side is about three-quarters of an inch in breadth in the middle. The whole of this margin is very finely striate nearly at right angles to the sides of the plate.

This margin is evidently the portion of the plate which was overlapped by the adjoining plates and in this respect the resemblance between it and the ventro-median plate of *Pterichthys oblongus* Ag. is obvious.

The outline of the plate corresponds very closely with that of the dorso-median plate of *Pterichthys*, and were it not perfectly flat I should be inclined to refer it to that part of the exo-skeleton. But this flatness renders it more probable that it represents the ventro-median or well known "lozenge-plate" of Hugh Miller—the central piece of the armor of this fish on the lower side—overlapped on all sides by others.

Prof. Whiteaves has very kindly lent me for comparison the original and only specimen of the ventro median plate of his new species, *Coccosteus Acadicus*. This, much more closely than my specimen, resembles the ventro-median plates of *Pterichthys* and *Coccosteus*, as given by Hugh Miller in his "Old Red Sandstone." It is quadrilateral, with two outwardly concave and two straight sides. The ornamentation is very peculiar, the plate being "quartered" if we may borrow an expression from heraldry, and having crenulated ridges parallel to the outer side in the first and fourth quarters and irregularly scattered tubercles in the second and third. Altogether it shows little resemblance to the plate here described.

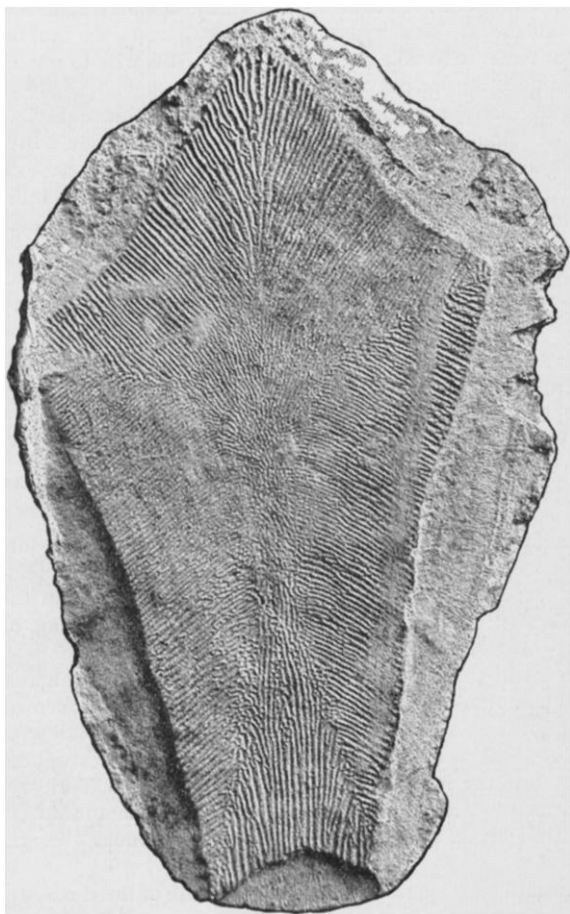
Prof. Newberry remarked in his letter that he very much doubted if the plate here described belonged strictly to *Pterichthys* and was inclined to consider it the type of a new genus. Probably this will be the result of a better knowledge of its structure, but it would be premature in this note to found a new genus on the fragments already known. When other parts of the exo-skeleton have been found it will be time to consider its generic position. Meanwhile I suggest for it the provisional name, *PTERICHTHYS RUGOSUS*.

The accompanying figure is taken from a photograph and will suffice to preserve the appearance of the specimen for future comparisons in the event of its loss or destruction.

On the Kingsmill White Sandstone. By E. W. Claypole.

(Read before the American Philosophical Society, April 6, 1883.)

Near the base of the red sandstones and shales which compose the Great Ponent series of Professor Rogers, lies a thin bed of white sandstone which promises to be of much interest, and perhaps of some importance in the



PTERICHTHYS? RUGOSUS, sp. n. UPPER CHEMUNG, PENNA. From a photograph of a plaster cast taken from the impression in sandstone.

geology of Perry county and of Middle Pennsylvania. In itself in nowise remarkable, it abounds in organic remains which when worked out will yield a rich fauna.

It is at present impossible to decide the *exact* horizon to which this sandstone belongs. For this reason, and to avoid prejudging the question, I have retained the term "Ponent." The transcendental nomenclature of Rogers is doomed to deserved extinction, but until we can determine finally what terms shall take the vacant places, it is wise to retain such of them as are necessary or convenient.

There is no question regarding the extent or signification of the term "Ponent" as employed by Professor Rogers. It is purely a lithological term, and is neither based on nor supported by palæontological evidence. In many parts of Middle Pennsylvania the dividing line which limits this Ponent Group is almost as easily seen in the rocks as on a geological diagram.

By the term "Ponent," Professor Rogers intended to designate all that great mass of red sandstone and shale, which intervenes between the top of his olive "Vergent" shales (Chemung of New York), and the Great Lower Carboniferous sandstone above them. The color and material of the beds are the sole foundations on which the distinction is based.

Palæontological considerations were not in the least regarded, partly because the time and means at the command of the First Survey forbade any extensive search for fossils, and partly because the great barrenness of these red shales and sandstones discouraged the same.

In New York, on the other hand, though fossils were also very scarce, yet an attempt was made by Professor Hall to establish a palæontological basis for his "Catskill Group," and the few relics that were obtained from the scanty exposures of these red shales and sandstones in that State were considered "characteristic." These are, strictly speaking, only two in number—*Holoptychius Americanus* and *Sauripteris Taylori*.

The base of the Catskill Group in New York is therefore double, lithological and palæontological. It may be to some extent an open question, whether or not these two horizons exactly coincide, and possibly the question may not admit of solution from the few and obscure exposures in that State. But until the coincidence of the horizons in New York with those in Pennsylvania is definitely settled, it would be premature to assume it. Consequently I retain for the present the term "Ponent" in writing of these beds.

The Kingsmill white sandstone lies near the base of these red sandstones and shales. Consequently it is in the Ponent Group of Pennsylvania. Its exact position is about 600 feet above the actual base of the red shales and sandstones. Palæontologically, the evidence leads to the same conclusion for about 400 feet below it are two fish-beds full of the remains of *Sauripteris* and *Holoptychius*. There is consequently no question of its position, judging from the data that have been hitherto accepted by geologists. Whether or not further examination of the Kingsmill sandstone will compel

some modification of these data time will show. As the lines of discrimination are now drawn, this sandstone must therefore be placed in the Ponent Group of Pennsylvania, and on palæontological evidence in the Catskill Group of New York. And no future changes can raise it. Any alteration, if made, can only lower it by placing it in the underlying or Chemung (Vergent) Group.

These details are necessary as an introduction to the facts and argument which follows.

Among the numerous fossils of the Kingsmill sandstone (many of which, though casts, are in excellent preservation, often showing the finest detail of structure), is one which at an early stage of the work arrested my attention. Its beautiful condition and the immense number in which it occurs were sufficient for this purpose. It is no exaggeration to say that at some of the exposures this fossil occurs in millions.

For some time I could get no clue to its name. At length, however, after going through with care all the material in my possession or within my reach, that bore upon the subject, I became almost certain that it was a fossil figured by Professor Hall in the geology of the Fourth District of New York, under the name *Cypricardia rhombea*. Possible inferences from this determination, however, deterred me from making use of the conclusion, and I laid the matter aside for further consideration.

Returning to the subject during the winter, while engaged in the study of my summer's collection, I found no reason whatever to distrust my previous determination, but in order to obtain the confirmation of another observer, I enclosed a specimen in a small parcel which I had occasion to send to Professor Whitfield, of the American Museum of Science, requesting his opinion on the identification. In his reply, he said :

"The shell sent is, I think, without question, *Schizodus rhombeus* Hall (*Cypricardia rhombea*) of the Fourth District Report. We have no really authentic specimens here, they being all in Professor Hall's hands at present."

In order to make the identification perfectly certain, I packed up a specimen, and sent it to Prof. Hall, with a request for his opinion upon it. In reply, he writes under date of March 10th, 1883.

"I do not perceive any important difference between the specimen sent, and *Schizodus rhombeus*, though I have not before had the casts of the interior, which I am glad to receive."

There remains therefore no doubt that the specimens here alluded to belong to the species *Schizodus rhombeus* Hall, of the Geological Report of the Fourth District of New York, where it was described and figured under the name of *Cypricardia rhombea*. It was found four miles north of Panama, Chautauqua county, New York, and attributed to the conglomerate at the base of the Carboniferous system. This opinion is now probably held by few or by no one. Prof. Hall said in the Twenty-third Regent's Report (p. 10) :

"In the original collections of the Geological Survey, some of the con-

glomerates of the southern counties containing certain fossils were referred to and arranged with the Chemung Group, while those from other localities, but without fossils, were referred to Carboniferous age. This latter reference arose from finding some ferruginous beds supposed to be outliers of the red sandstone of Tioga, near the summits of some of the hills and below the conglomerates. These have since been proved by their contained fossils to belong to the Chemung Group, and it has not yet (1871) been demonstrated that the red sandstone of the adjacent part of Pennsylvania does occur within the limits of the south-western counties of New York.

"To a very great extent the conglomerates have been ascertained to belong to the Chemung Group, and to contain numerous fossils of that formation, while in some localities at least two hundred feet of shales and shaly sandstones, charged with Chemung fossils, lie above the conglomerates. So many localities have now been examined that we may conclude that all the conglomerates of the southern counties are of the age of the Chemung, but from the great difference in character of the fossils from different localities, it may not be regarded as proven that these beds are all of the same horizon.

"The relations of some of the outlying conglomerates south of Olean in New York and the adjacent parts of Pennsylvania in McKean county, to the Chemung Group and Coal Measures have not yet been satisfactorily determined."

Mr. Carll in Report III has given a minute account of the Panama conglomerate at its several exposures in Chautauqua county, New York, and has pointed out its peculiarities. He has also given a list of fossils obtained from it, which agrees, so far as the species were determined, with that given by Prof. Hall (Geol. 4th Dist. p. 291), except in one point. The following are the lists :

Prof. Hall's list.

Euomphalus depressus
Cypriocardia rhombea
Cypriocardia contracta

Mr. Carll's list.

Euomphalus depressus
Cypriocardia rhombea
Cypriocardia contracta
Spirifer disjunctus

Mr. Carll does not give his locality, but as he describes a quarry four miles north of Panama, it may be inferred that he obtained some of them there. This is the locality mentioned by Prof. Hall.

One curious fact is the great discordance between the two accounts of the rock. Prof. Hall says :

"Fossils are exceedingly rare in this rock, having been seen in one locality only, four miles north of Panama."

Mr. Carll says :

"One of the exceptional features of the Panama rock is the great abundance of fossils found associated with it, and even in the pebble mass itself."

Probably, judging from the resemblance between the lists given above, the abundance of fossils is a local character of the rock. In this way we may perhaps reconcile the two accounts.

Without laying too much stress on a single species, it may be worth consideration whether or not the Panama conglomerate of Report III may be of approximately the same age as the Kingsmill white sandstone above described.

The following points of resemblance may be noted :

1. The Kingsmill sandstone is often conglomeratic.
2. The Kingsmill sandstone contains abundance of flat lenticular quartz pebbles. I have never seen a pebble of any other shape in it. This is a distinguishing feature of the Panama rock according to Mr. Carll and Mr. Ashburner.
3. The Kingsmill sandstones contain abundance of fossils, among which, in one locality at least, is found in profusion *Schizodus rhombeus*, one of the three characteristic species of the Panama rock.

The Sub-Olean or Sub-Garland conglomerate of Messrs. Carll and Ashburner is the only other conglomerate in that part of Pennsylvania holding similar flat pebbles. See Rep. III.

I have not yet identified with certainty either of the other three species mentioned by Prof. Hall and Mr. Carll to occur near Panama in the conglomerate, but so far as I have yet observed *Schizodus rhombeus* is strictly limited in Perry county to this single bed of sandstone not exceeding ten feet in thickness. A scarce form, usually imperfect, much resembles *S. contractus* (*Cypriocardia contracta*), and may prove to be so. The Gasteropods are in so ill preserved a condition that their identification is attended with great difficulty.

If any importance be attached to this suggestion, it only remains to point out the horizon of the Kingsmill sandstone, which admits of no doubt, although it may admit of slight differences of opinion. As mentioned at the beginning of this note, it lies near the base of the great "Ponent" series of Prof. Rogers. It must, therefore, be about the top of the Chemung or the base of the Catskill of New York, or perhaps better in what we may call the "Chemung-Catskill passage beds." It is not probable that the palæontological evidence, when complete, will warrant the placing of this sandstone and its associated strata fully within either of these two great groups of New York.

The Kingsmill sandstone cannot of course be a continuation, unchanged, of the Panama conglomerate for, according to the testimony of Mr. Carll and Mr. Ashburner, the latter graduates down into soft shales when followed a few miles to the south-east of Panama. But it may be a bed on the same or nearly the same horizon, and the deposit of a sea tenanted by the same species. It may even be a continuation of the same bed taking on its sandy nature again in consequence of changed conditions.

It only remains to add that, though the three or four species above enumerated form the whole of the known fauna of the Panama conglomerate*

* The list of fossils from the Panama conglomerate or its associated conglomerates has apparently been increased since the publication of the Geology of New York, by the addition of the following three species :

Edmondia æquimarginalis = *Cardinia æquimarginalis* Win.

Allorisma Hannibalensis = *Grammysia Hannibalensis* Shumard.

Sanguinolites clavulus Hall.

in New York, yet the Kingsmill sandstone contain a rich fauna, the names of which will form, when worked out, a long list.

In addition to what has been said above concerning the fossils of the Panama conglomerate, the following notes are worthy of a little space.

Prof. A. Winchell in a paper printed in the Proceedings of the Acad. of Nat. Sciences, 1865, says, when speaking of the fossils of the Marshall Group of Michigan :

"Perhaps the most interesting feature of all is the identification of four Western species with fossils contained in the supposed Carboniferous conglomerate of Western New York. These are :

Euomphalus depressus Hall = *Straparollus Ammon* White.

Cypricardia contracta Hall = *Edmondia bicarinata* Win.

= *Sanguinolites rigidus* Win.

= *Cypricardia rigida* White and Whitf.

Edmondia æquimarginalis Win.

Allorisma Hannibalensis Shum.

"Further than this, two of the above species—*E. æquimarginalis* and *Allorisma Hannibalensis*—occur in what has been regarded as another conglomerate whose position is beneath the first, and at the top of the Chemung rocks of Western New York."

In regard to this last remark, Mr. Ashburner in Report III, pp. 70-79, says that the Panama conglomerate is the lowest sandstone in the N. W. of Pennsylvania and S. W. of New York. He says that an oil well sunk close to the base of the Panama rock passed through 1200 feet of soft shale and slate, and that other wells in the region gave similar sections. He says that, granting all the conglomerates cropping out and forming rock-cities along the State line hills to be distinct beds, they lie thus :

1. Olean (Garland = Sharon = Ohio).
2. Sub-Olean, Sub-Garland, Shenango.
3. Tunangwant.
4. Salamanca.
5. Panama.

On his view, therefore, there is no older conglomerate than the Panama in the region.

Prof. Winchell argues that because these four species occur in the Marshall Group in Michigan, and in the Panama (or its equivalent) conglomerates of New York, therefore the Marshall Group is more or less the equivalent of these conglomerates which he assumes to be of Lower Carboniferous age as stated in the Geology of New York. Consequently, he infers that the Marshall grits and conglomerates of Michigan are of Lower Carboniferous age. The evidence given above, shows that one of the species of the Panama conglomerate is not Lower Carboniferous, but belongs at the base of the Catskill. The other species may be found in the same horizon. The inference from this datum, somewhat slender it is true, is

that the Panama conglomerate belongs to the base of the Catskill, and probably also the Marshall grits of Michigan.

No representative of the Catskill has yet been found or recognized so far as I am aware in Michigan. A gap is left in the Michigan section between the Chemung and the Lower Carboniferous.

Mr. Lesley remarked on this paper of Prof. Claypole's, that he could not agree with the sentiment expressed in its introduction respecting the doubtful propriety of the use of the term "Catskill formation" as an equivalent of Prof. Roger's "Ponent formation."

It is a mistake to suppose that the "Catskill formation" was based in any degree upon fossil forms, any more than was the "Ponent." The two terms are completely and exactly identical. The New York geologist meant by it the red rocks constituting the Catskill Mountain massif, overlooking the Hudson valley, and extending unbroken far into Pennsylvania, and in fact through Pennsylvania into Maryland and Virginia. It was described as a pile of nearly horizontal Devonian strata destitute of fossils remains, except a few macerated plants and one or two types of fish. Mr. Rogers had to describe the same mass of strata, with the same lithological constitution and topographical aspect, and perfectly continuous with it geographically. There never was any question, nor is there now any question of the identity of this mass of strata in the two States. But as Mr. Rogers declined to accept any of the Palæozoic names of New York and invented a new nomenclature for his own use in Pennsylvania, he substituted *Ponent* for "Catskill," as he substituted *Medidial* for "Oriskany," *Postmedidial* for "Upper Helderberg," *Cadent* for "Hamilton," *Vergent* for "Chemung and Portage," &c. The only essential change he made was in giving a separate name, *Vespertine*, to the gray sandstone strata forming the peaks of the Catskill. These had been left unnamed (or included under the general name "Catskill") because the N. Y. geologists had no clue to their topographical significance, which only appears after passing west of the Lehigh, where, upturned vertically, they constitute a separate range of mountain.

In the reports of the Second Geological Survey the transcendental nomenclature of the brothers Rogers has been set aside in favor of the older, classical and generally accepted nomenclature of the New York geologists. As the gray sands of the Catskill peaks form the top coating of the Pocono tableland in Pennsylvania, the name "Pocono" has been substituted for *Vespertine*; but this leaves the term *Ponent* represented, as it always has been, by "Catskill."